POLR3A gene

RNA polymerase III subunit A

Normal Function

The *POLR3A* gene provides instructions for making the largest part (subunit) of an enzyme called RNA polymerase III. This enzyme is involved in the production (synthesis) of ribonucleic acid (RNA), a chemical cousin of DNA. The RNA polymerase III enzyme attaches (binds) to DNA and synthesizes RNA in accordance with the instructions carried by the DNA, a process called transcription. RNA polymerase III helps synthesize several forms of RNA, including ribosomal RNA (rRNA) and transfer RNA (tRNA). Molecules of rRNA and tRNA assemble protein building blocks (amino acids) into working proteins; this process is essential for the normal functioning and survival of cells.

Health Conditions Related to Genetic Changes

Pol III-related leukodystrophy

At least 27 *POLR3A* gene mutations have been associated with Pol III-related leukodystrophy. Leukodystrophies are conditions that involve abnormalities of the nervous system's white matter. White matter consists of nerve fibers covered by a fatty substance called myelin, which insulates nerve fibers and promotes the rapid transmission of nerve impulses. A reduced ability to form myelin (hypomyelination) leads to the signs and symptoms of Pol III-related leukodystrophy, which include intellectual disability and difficulty with coordinating movements (ataxia). Development of the teeth (dentition) is also abnormal in this disorder.

In Pol III-related leukodystrophy, *POLR3A* gene mutations may impair the ability of the subunits of the RNA polymerase III enzyme to assemble properly or result in an RNA polymerase III with impaired ability to bind to DNA. Reduced function of the RNA polymerase III molecule likely affects development and function of many parts of the body, but the relationship between *POLR3A* gene mutations and the specific signs and symptoms of this disorder is unknown.

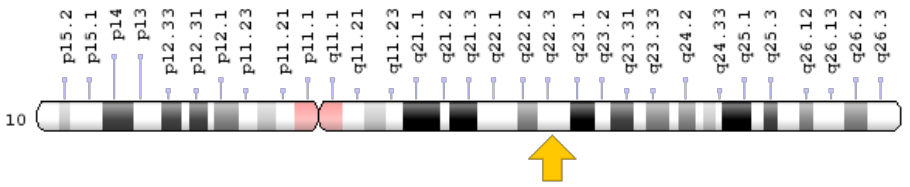
People with Pol III-related leukodystrophy may have different combinations of its signs and symptoms. These varied combinations of clinical features were originally described as separate disorders. Affected individuals may be diagnosed with ataxia, delayed dentition, and hypomyelination (ADDH); hypomyelination, hypodontia, hypogonadotropic hypogonadism (4H syndrome); tremor-ataxia with central hypomyelination (TACH); leukodystrophy with oligodontia (LO); or hypomyelination with cerebellar atrophy and hypoplasia of the corpus callosum (HCAHC). Because

these disorders were later found to have the same genetic cause, researchers now group them as variations of the single condition Pol III-related leukodystrophy.

Chromosomal Location

Cytogenetic Location: 10q22.3, which is the long (q) arm of chromosome 10 at position 22.3

Molecular Location: base pairs 77,975,149 to 78,029,540 on chromosome 10 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- ADDH
- DNA-directed RNA polymerase III largest subunit
- DNA-directed RNA polymerase III subunit A
- DNA-directed RNA polymerase III subunit RPC1
- HLD7
- hRPC155
- polymerase (RNA) III (DNA directed) polypeptide A, 155kDa
- polymerase (RNA) III subunit A
- RNA polymerase III 155 kDa subunit
- RNA polymerase III subunit C1
- RNA polymerase III subunit C160
- RNA polymerase III subunit RPC155-D
- RPC1
- RPC1_HUMAN
- RPC155

Additional Information & Resources

Educational Resources

- The Cell: A Molecular Approach (second edition, 2000): Eukaryotic RNA Polymerases and General Transcription Factors
  https://www.ncbi.nlm.nih.gov/books/NBK9935/

GeneReviews

- Pol III-Related Leukodystrophies
  https://www.ncbi.nlm.nih.gov/books/NBK99167

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28POLR3A%5BTIAB%5D%29+OR+%28%28ADDH%5BTIAB%5D%29+OR+%28HLD7%5BTIAB%5D%29+OR+%28RPC1%5BTIAB%5D%29+OR+%28RPC155%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D

OMIM

- POLYMERASE III, RNA, SUBUNIT A
  http://omim.org/entry/614258

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_POLR3A.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=POLR3A%5Bgene%5D
- HGNC Gene Family: RNA polymerase subunits
  http://www.genenames.org/cgi-bin/genefamilies/set/726
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=30074
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/11128
- UniProt
  http://www.uniprot.org/uniprot/O14802

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